

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A communication device for transmitting and/or receiving signals by using a communication antenna, said communication device comprising:

signal characteristic information detection means for detecting information regarding signal characteristics of a calibration signal contained in a signal received by the communication antenna;

calibration means for calibrating a communication antenna chain based on the ~~detected~~ signal characteristic information detected by said signal characteristic information detection means;

~~— cancellation signal generating means for generating a cancellation signal corresponding to a calibration signal contained in the signal received by the communication antenna based on the calibration signal;~~

~~— signal cancellation by subtraction means for subtracting the generated cancellation signal from the signal received by the communication antenna; and~~

~~— receive signal processing means for processing the received signal diminished by the cancellation signal.~~

calibration signal cancellation means for removing a signal identical or substantially identical to the calibration signal from the signal received by the communication antenna; and

receive signal processing means for processing the received signal which is diminished by the signal identical or substantially identical to the calibration signal.

2. (Previously Presented) A communication device according to claim 1, further comprising a calibration signal transmitting antenna for transmitting a calibration signal to the communication antenna.

3. (Currently Amended) A communication device according to claim 1, further comprising:

calibration signal transmitting means for transmitting a calibration signal from a communication antenna; and

a calibration signal receiving antenna for receiving the calibration signal transmitted from the communication antenna;

wherein said ~~the~~ signal characteristic information detection means ~~detecting~~ detects information regarding the signal characteristics of the calibration signal received by ~~the~~ said calibration signal receiving antenna, and

~~the~~ said calibration means ~~calibrating~~ calibrates the communication antenna chain based on the ~~detected~~ signal characteristic information detected by said signal characteristic information detection means.

4. (Currently Amended) A communication device according to claim 2, further comprising:

calibration signal transmitting means for transmitting a calibration signal from a communication antenna; and

a calibration signal receiving antenna for receiving the calibration signal transmitted from the communication antenna;

wherein said ~~the~~ signal characteristic information detection means ~~detecting~~ detects information regarding the signal characteristics of the calibration signal received by ~~the~~ said calibration signal receiving antenna, and

~~the~~ said calibration means ~~calibrating~~ calibrates the communication antenna chain based on the ~~detected~~ signal characteristic information detected by said signal characteristic information detection means.

5. (Currently Amended) A communication device according to claim 1, further comprising: a signal generator for generating a signal of a prescribed frequency for converting signal frequency,

wherein a frequency signal generated by a common signal generator ~~being~~ is supplied to multiple antenna chains including all communication antenna chains.

6. (Currently Amended) A communication device according to claim 2, further comprising: a signal generator for generating a signal of a prescribed frequency for converting a signal frequency,

„ wherein a frequency signal generated by a common signal generator ~~being is~~ supplied to multiple antenna chains including all communication antenna chains.

7. (Currently Amended) A communication device according to claim 3, further comprising: a signal generator for generating a signal of a prescribed frequency for converting a signal frequency,

wherein a frequency signal generated by a common signal generator ~~being is~~ supplied to multiple antenna chains including all communication antenna chains.

8. (Currently Amended) A communication device according to claim 4, further comprising: a signal generator for generating a signal of a prescribed frequency for converting a signal frequency,

wherein a frequency signal generated by a common signal generator ~~being is~~ supplied to multiple antenna chains including all communication antenna chains.

9. (Currently Amended) A communication device according claim 1, wherein the communication antenna performs transmission/reception of a calibration signal ~~by the communication antenna and~~ said signal characteristic information detection means performs detection of information regarding signal characteristics of the calibration signal ~~by the signal characteristic information detection means are performed~~ at intervals.

10. (Currently Amended) A communication device according claim 2, wherein the communication antenna performs transmission/reception of a calibration signal ~~by the communication antenna and~~ said signal characteristic information detection means performs detection of information regarding signal characteristics of the calibration signal ~~by the signal characteristic information detection means are performed~~ at intervals.

11. (Currently Amended) A communication device according claim 3, wherein the communication antenna performs transmission/reception of a calibration signal ~~by the communication antenna and~~ said signal characteristic information detection means performs detection of information regarding signal characteristics of the calibration signal

~~by the signal characteristic information detection means are performed at intervals.~~

12. (Currently Amended) A communication device according claim 4, wherein the communication antenna performs transmission/reception of a calibration signal ~~by the communication antenna and~~ said signal characteristic information detection means performs detection of information regarding signal characteristics of the calibration signal ~~by the signal characteristic information detection means are performed at intervals.~~

13. (Currently Amended) A communication device according claim 5, wherein the communication antenna performs transmission/reception of a calibration signal ~~by the communication antenna and~~ said signal characteristic information detection means performs detection of information regarding signal characteristics of the calibration signal ~~by the signal characteristic information detection means are performed at intervals.~~

14. (Currently Amended) A communication device according claim 6, wherein the communication antenna performs transmission/reception of a calibration signal ~~by the communication antenna and~~ said signal characteristic information detection means performs detection of information regarding signal characteristics of the calibration signal ~~by the signal characteristic information detection means are performed at intervals.~~

15. (Currently Amended) A communication device according claim 7, wherein the communication antenna performs transmission/reception of a calibration signal ~~by the communication antenna and~~ said signal characteristic information detection means performs detection of information regarding signal characteristics of the calibration signal ~~by the signal characteristic information detection means are performed at intervals.~~

16. (Currently Amended) A communication device according claim 8, wherein the communication antenna performs transmission/reception of a calibration signal ~~by the communication antenna and~~ said signal characteristic information detection means performs detection of information regarding signal characteristics of the calibration signal ~~by the signal characteristic information detection means are performed at intervals.~~

17. (Currently Amended) A CDMA base station comprising:

n number of communication antennas constituting an adaptive array antenna, n being greater than 1;

n number of transceiver units; and

n number of calibration signal cancellers, which members constitute said n number of communication antennas, said n number of transceiver units, and said n number of calibration signal cancellers constituting n number of communication antenna chains; and

a user-segregated AAA signal processor and discriminator which is common to the said n number of communication antenna chains; wherein:

each calibration signal ~~canceller~~ canceller includes a despreader, a phase/gain error detector, a calibration signal generator, a complex multiplier and a subtracter;

each communication antenna ~~transmits~~ is operable to transmit and receives receive spread spectrum signals to and from mobile stations by radio;

each ~~receiver-transceiver~~ unit ~~conducts~~ is operable to conduct receive processing consisting of frequency-converting and orthogonally detecting received signals acquired from the associated communication antenna and outputting the result of the orthogonal detection to the associated calibration signal ~~canceller~~ canceller, and ~~conducting to conduct~~ transmit processing consisting of orthogonally modulating and frequency-converting a transmit signal received from the associated calibration signal ~~canceller~~ canceller and outputting the result to the associated communication antenna;

for each calibration signal canceller,

~~the said despreader of each calibration signal canceller acquires~~ is operable to acquire the received signal from the associated communication antenna, ~~despreads it to despread the received signal by~~ using a spreading code corresponding to the calibration signal, thereby detecting the calibration signal contained in the received signal, and ~~outputs to output~~ the detection result to the associated phase/gain error detector, wherein

~~the said associated phase/gain error detector detects~~ is operable to detect the phase variation and gain variation of the calibration signal based on the

the detection result received from ~~the said~~ despreader, ~~deletes to delete~~ the phase component of the calibration signal produced on the calibration signal transmission side from the received calibration signal, and ~~outputs to output~~ the result after deletion to the associated complex multiplier,

the associated calibration signal generator ~~generates~~ is operable to generate a signal identical to the calibration signal transmitted from the calibration signal transmission side and ~~outputs to output~~ the generated signal to the associated complex multiplier,

~~the said associated~~ complex multiplier is operable to complex-multiply ~~complex-multiplies~~ the result after deletion received from ~~the said associated~~ phase/gain error detector and the generated signal received from ~~the said associated~~ calibration signal generator, and to output ~~outputs~~ the multiplication result to the associated subtracter as a cancellation signal,

~~the said associated~~ subtracter ~~subtracts~~ is operable to subtract the cancellation signal received from ~~the said associated~~ complex multiplier from the received signal of the associated communication antenna chain input thereto by the associated transceiver unit, and to output ~~outputs~~ the received signal after subtraction to ~~the said~~ user-segregated AAA signal processor and discriminator; and

~~the said~~ user-segregated AAA signal processor and discriminator is operable to ~~conducts-conduct~~ receive processing consisting of acquiring the received signals of the communication antenna chains from the calibration signal ~~cancellers~~ cancellers, multiplying ~~these~~ the received signals of the communication antenna chains and receive weights which are applied to ~~the said~~ communication antenna chains, and synthesizing the multiplication results for all communication antenna chains so as to produce a synthesis result that is a received signal of ~~the said~~ adaptive array antenna, wherein the receive ~~this processing being done~~ is performed for every mobile station,

~~conducts-conduct~~ transmit processing consisting of modulating user specific data for X' number of users, summing the modulated signals so as to produce transmit signals, and multiplying the transmit signals and transmit weights which are applied to ~~the said~~ communication antenna chains, and

~~..~~ ~~outputs-output~~ the multiplication results for the respective communication antenna chains to ~~the said~~ transceiver units via ~~the said~~ calibration signal ~~-cancelers~~cancellers.

18. (Currently Amended) The CDMA base station according to claim 17, further comprising:

a calibration signal transmitting/receiving antenna;

a calibration signal transceiver unit; and

a calibration signal processor; wherein:

~~the said~~ calibration signal processor includes a calibration signal generator, a spreading code generator, a despreader, a phase/gain error detector and a controller;

~~the said~~ calibration signal transmitting/receiving antenna is operable to radio-transmit ~~radio-transmits~~ a calibration signal input thereto from ~~the said~~ calibration signal transceiver unit and ~~outputs-to output~~ signals received by radio transmission to ~~the said~~ calibration signal transceiver unit;

~~the said~~ calibration signal transceiver unit ~~receives-is operable to~~

receive the calibration signal from ~~the said~~ calibration signal processor, orthogonally ~~modulates-modulate~~ and ~~frequency-converts-it~~ frequency-convert ~~the received calibration signal,~~ and ~~outputs-it-output~~ the modulated and frequency-converted calibration signal to ~~the said~~ calibration signal transmitting/receiving antenna, and

~~acquires-acquire~~ received signals from ~~the said~~ calibration signal transmitting/receiving antenna, ~~frequency-converts-frequency-convert~~ and orthogonally ~~detects-them~~ detect the received signals, and ~~outputs-output~~ the result of the orthogonal detection to ~~the said~~ calibrating signal processor;

in a transmission system of ~~the said~~ calibration signal processor, when performing receive calibration of a communication antenna chain, ~~the said~~ calibrating signal generator ~~operates-is operable to operate~~ under the control of ~~the said~~ controller so as to generate a fixed spreading code as a calibration signal and to output the calibration signal to ~~the said~~ calibration signal transceiver unit; and

in a reception system of ~~the said~~ calibration signal processor during transmit calibration of a communication antenna chain upon reception of a calibration signal among calibration signals transmitted in turn from ~~the said~~ communication antenna chains,

~~the said~~ controller ~~instructs~~ is operable to instruct said ~~the~~ spreading code generator to generate a spreading code corresponding to the received calibration signal, and ~~the said~~ spreading code generator ~~operates~~ is operable to operate under the control of ~~the said~~ controller so as to generate the instructed spreading code and output ~~it~~ the generated spreading code to the said despreader said calibration signal processor,

~~the said~~ despreader said calibration signal processor ~~correlates~~ is operable to correlate the received signal acquired from ~~the said~~ calibration signal transceiver unit and the spreading code supplied by ~~the said~~ spreading code generator, and

~~the said~~ phase/gain error detector ~~detects~~ is operable to detect the phase variation and gain variation of the calibration signal based on the despreading result received from ~~the said~~ despreader said calibration signal processor.

19. (Currently Amended) The CDMA base station according to claim 18, wherein:
~~the a~~ receiver unit of each communication antenna chain includes a low noise amplifier, a mixer, a band pass filter, an auto gain controller, an orthogonal detector, and low pass filters;

~~the a~~ transmitter unit of each communication antenna chain includes low pass filters, an orthogonal modulator, a band pass filter, a mixer, a band pass filter, and a power amplifier;

~~the a~~ calibration chain transmitter unit comprises low pass filters, an orthogonal modulator, a band pass filter, a mixer and a band pass filter;

~~the a~~ calibration chain receiver unit comprises a mixer, a band pass filter, an orthogonal detector, and low pass filters;

~~the receive side~~said mixers of ~~the said receiver units of said~~ communication antenna chains and ~~the transmit side~~said mixer of ~~the said~~ calibration chain transmitter unit are supplied with a receive side first local frequency signal generated by a common first signal generator, and ~~the receive side~~said orthogonal detectors of ~~the said receiver units of said~~ communication antenna chains and ~~the transmit side~~said orthogonal modulator of ~~the said~~ calibration chain transmitter unit are supplied with a receive side second local frequency signal generated by a common second signal generator; and

~~the transmit side~~said orthogonal modulators of ~~the said transmitter units of said~~ communication antenna chains and ~~the receive side~~said orthogonal detector of ~~the said~~ calibration chain receiver unit are supplied with a transmit side first local frequency signal generated by a common third signal generator, and ~~the transmit~~said mixers of said transmitter unit of said ~~the communication antenna chains and the receive side~~said mixer of ~~the said~~ calibration chain receiver unit are supplied with a transmit side second local frequency signal generated by a common fourth signal generator.